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THE JOURNAL OF ENGINEERING EDUCATION

Published by the Society for the Promotion of Engineering Education

Published monthly, except July and August, under the supervision of the Publication Committee. Ora M. Leland, George B. Pegram, F. L. Bishop, Editor, University of Pittsburgh. Published at Prince and Lemon Sts., Lancaster, Pa.

Entered as second-class matter at the Post Office at Lancaster, Pa., under the Act of August 12, 1912.

New Series Vol. XVII, No. 8. APRIL, 1927 Subscription Price, $3.00 per year. Single Copies, 50 cents.

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SUMMER SCHOOLS FOR ENGINEERING TEACHERS, THEIR AIMS AND METHODS.

BY W. E. WICKENDEN,

Director of Investigation.

How do the proposed summer schools for engineering teachers fit into the general plan for the development of engineering education? Does the project involve more than a coaching school where groups of young instructors may learn the tricks of the trade from some of their more practiced seniors?

It seems to be the clear logic of the situation that the great majority of our engineering colleges should provide a complete and distinctive type of higher education to meet the needs of a rather well defined section of our youth. This type of education will involve no abrupt transition from cultural to technical preparation. It will be a coherent and unified program with the merits of a well balanced table d'hote meal rather than a random sampling from an intellectual cafeteria. Humanistic work and scientific work alike will be chosen with regard to the functions of the engineer in society but the program will not pretend to be a complete professional discipline—it will be a *professionally oriented college course*. It will be more exacting than an ordinary college course; there will be more work to do and harder work; difficult analytical subjects will have to be taken early in the curriculum; subjects will link up in sequences so that poor work at one stage is certain to leave its mark at another.

The students will not be the mature, upgraded and presifted type of material found in the Class A medical school, but the more heterogeneous product of the public high schools. Many of them will come seeking a specific technical training and will have to be persuaded of the merits of a broad general education. We can not insist that the student accommodate himself to whatever instruction the teacher chooses to give;

in the early stages, at least, the work will have to be adjusted to the student. More than average motivation will be needed to maintain morale and better than average teaching to keep the whole process above the level of a laborious routine.

There is no reason why a well planned engineering curriculum should not offer one of the most effective forms of broad education. It is more a matter of the quality of teaching than of details of subject matter—more a question of the architect than of the kind of bricks. In reality, teacher and subject matter can not be separated. Subjects can not be taught in isolation and achieve the result desired, but must be treated as a part of a developing whole. Little good will result from asking one expert to designate the subject matter and another to specify the teaching methods, nor is much gain to be expected from handing our younger teachers over to the colleges of education. The Society has been able to accomplish some good results through voluntary committees. Committees are able to make surveys and prepare reports, and occasionally legislate for the rest of us, but scarcely to do original creative work.

What seems to be needed is some new form of teamwork, bringing together the subject matter expert and the methods expert on our own premises. Groups of men need to get together and actually work out the problems of content and method, then give the rest of us the fruits of their labor. A group ought to take some division of the curriculum and explore it, both to survey its content and its new frontiers and to see how it borrows from and contributes to other divisions of study. They need to appraise its value to different groups of students, to examine critically the different methods of presentation in use, to work up and try out unit assignments and projects for students, to test various methods of measuring the student's progress and attainments, to survey current problems of research, and to map out programs of original work for themselves. Some of the men in the group ought to be the ablest teachers of the subject, men of mature years to serve as leaders of the group; some ought to represent other subjects which are closely related to the principal one

under study; some ought to be the known progressives in matters of method; some ought to be experts in method as such; some ought to be detached enough to make good critics; but most of the group ought to be young men struggling with teaching problems and having the strongest possible incentive for the success of the effort. There ought to be some good teaching, but no very sharp distinction between teachers and taught. The principal thing, however, is that they get together and work at the problem systematically, intensively and enthusiastically.

These are ideals for the Society's new undertaking, the summer schools for engineering teachers. The subject of mechanics seems to furnish an ideal test case for a trial year. It is taught in every curriculum; it occupies the pivotal position between the general sciences and the more specific technical subjects; it runs a constant risk of becoming conventionalized; and it is capable of becoming notably serviceable to subjects which follow if taught with vision and vigor. If we succeed with this effort and prove the effectiveness of the method, we may be able to extend the plan both ways, to cover in time the introductory sciences, the technical subjects and the humanistic subjects as well, and so bring the entire curriculum under a scheme of examination and development in rotation. Participation in such a development process is the best form of preparation for younger teachers which we have been able to devise. If we work the process out as a common undertaking of the Society, the colleges may find in it the clue to the much needed process for developing their teachers at the home base.

The officers of the Carnegie Corporation, in recommending a special grant for the expenses of the first year, expressed a lively interest in the pioneer values of the project. Here, perhaps for the first time, an organization which represents one of the principal divisions of higher education, is accepting the responsibility for improving its own teaching processes, planning a systematic attack on the problem by cooperative methods, and inviting the exponents of educational method to a share in the task.

THE UNIVERSITY OF MAINE.

"Where the sun comes up."

BY CHARLES F. WESTON.

Professor of Mechanics.

In its daily trip from the Atlantic to the Pracific the sun may shine more warmly upon some other of the universities of the United States but the University of Maine has the distinction of being the one upon which it shines first, which may be a partial justification for the fact that the university carries upon its seal the motto of the state, DIRIGO.

One of the metropolitan dailies recently created some amusement among those who know the geography of the state by describing Presque Isle as "an island off the northeast coast of Maine," which it certainly is not, as its name bears witness. The University of Maine is, however, situated on an island, but on an island so large that the branch of the Penobscot River which forms the western boundary of the island, as well as of the university campus, is called the Stillwater River. An adjoining island to the north, called Indian Island, is the home of the remnant of the tribe of Penobscot Indians.

In the town of Orono, named for an Indian chief famous here in the olden days, about eight miles from Bangor on the state road leading through Houlton to the provinces, the university has grown up on a gentle slope facing the sunset, to be one of the beauty spots of the state. Next June, when nature is at her loveliest, the campus will "put its best foot foremost" to give a royal welcome to the friends and delegates who come here to attend the S. P. E. E. Convention.

The state of Maine, with its widely diversified landscape, is well known as a summer vacation land, for it is, as we frequently and fondly sing of it in our university hymn, a

Land of the forest, lake, and sea
Of mountain peak and lordly pine

H. S. BOARDMAN.

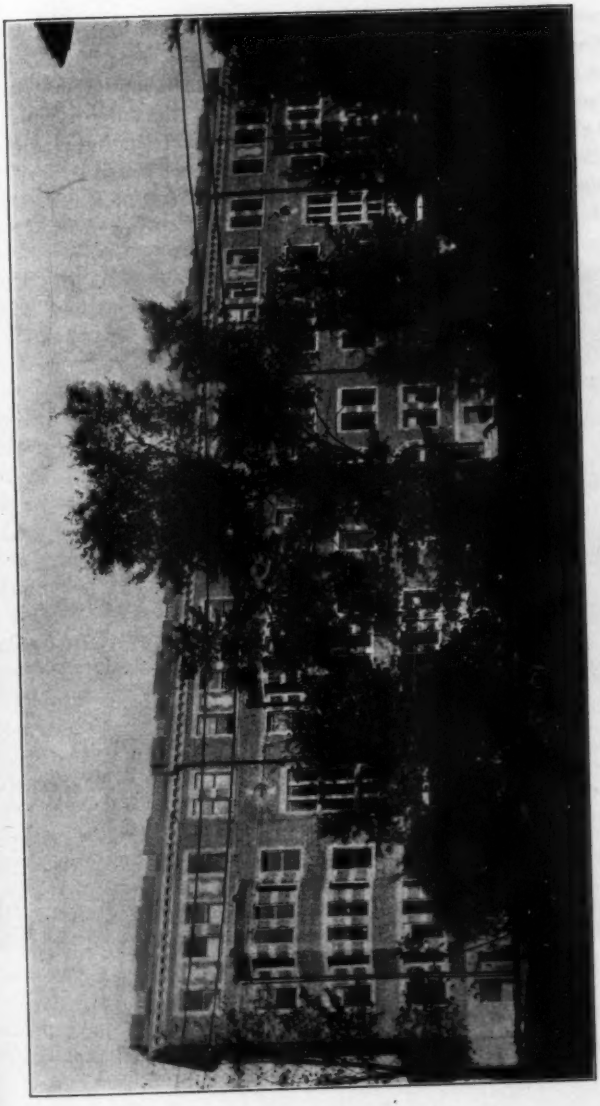
and visitors in June will see it under ideal conditions. In order that they may not find the University of Maine a total stranger to them when they come here, I have been asked to introduce it to them in a "few well chosen words" so that they may be better prepared to come and really get acquainted.

The institution had its birth in March 1863 when the state legislature voted to accept the provisions of the Morrill Act and pledged the state to the support of at least one college to "promote the liberal and practical education of the industrial classes," but although the new institution was one of the many legitimate offsprings of this land-grant act, there seemed to be some disposition in the state to treat it as a foundling.

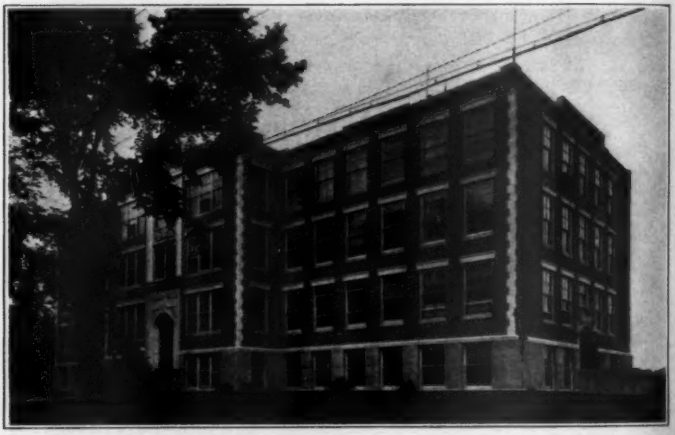
Several of the colleges in the state offered to adopt and shelter it under conditions similar to those ordinarily accorded to "poor relations," one professor suggesting that his college could "give it more decent burial than any other," but wiser counsel prevailed and it was finally decided to give it an independent establishment in the town of Orono, where, in the fall of 1868, it opened its doors for the admission of students, or perhaps I should say its door, for a single building, afterwards named White Hall, served as a combination dormitory, classroom, and office building.

Twelve students entered in the first class, the number increasing to eighteen before the end of the year, and four years later six of these men graduated to become the first alumni group of this new institution which had been duly christened the Maine State College of Agriculture and the Mechanic Arts. The faculty consisted of two men, one of whom served as "Acting President and Professor of Mathematics and Physics" while the other bore the less impressive title of "Farm Superintendent and Instructor in Agriculture." The equipment of apparatus, consisting of physical geography charts and a few pieces of physical apparatus, to the total value of $141.65, was stored in the president's office in White Hall.

About thirty years later, the student enrollment having increased to about 450 and the faculty list including nearly 50, the name of the institution was changed to the University of Maine, the first women's dormitory was built, and the insti-



tution started on a period of marked growth and expansion. Now, as we near the end of the third decade since the adoption of the new name the student enrollment is about 1,500 with a faculty list of more than 200 names, while the curricula of Agriculture, Civil Engineering, Mechanical Engineering, and Elective, first arranged in 1871, have developed into the College of Agriculture, the College of Technology, and the College of Arts and Sciences.



AUBERT HALL.

During the war the university was forced to discontinue the College of Law and the Department of Pharmacy. There have been many demands for their reorganization but the university seems to be committed to a policy of trying to develop its teaching personnel and equipment rather than to increase its enrollment or extend its educational scope. It has been suggested that an economic survey of the state should be made to determine more exactly the part the university ought to play in the educational system of the state.

It is interesting to note that by far the largest part of the student body is of native New England stock and that about

ninety per cent of the students come from the State of Maine. Of the 6,800 living former students about one-half are still located in the State of Maine, one quarter in New England outside of the State of Maine, while the others are scattered all over the world.

The registration in the College of Technology is now nearly equal to the total enrollment in the entire institution at the time it became the University of Maine, and the various departments of this college are housed in three academic buildings, two of which have been built since that time, while the third, called Wingate Hall, arose from the ashes of old White Hall after it burned in 1890. A new building, the gift of an early alumnus of the institution, is now in process of construction. It is designed to house the laboratory equipment of the department of Mechanical Engineering and to furnish space for the development of an up-to-date hydraulics laboratory. It is hoped and expected that this building will be but a portion of a more extensive building adequate to accommodate the departments of Mechanical Engineering, Mechanics, and Engineering Drawing, and to furnish office space for the Dean of the College of Technology.

LORD HALL.

Maine is a paper mill state and the University of Maine was the first to offer a "Pulp and Paper" curriculum which has

attracted students from China and Japan and continues to be popular. The streams of Maine offer wonderful possibilities in the way of hydro-electric development, less than fifty per cent of the million horse-power having been developed, and our graduates are playing their part in this great work.

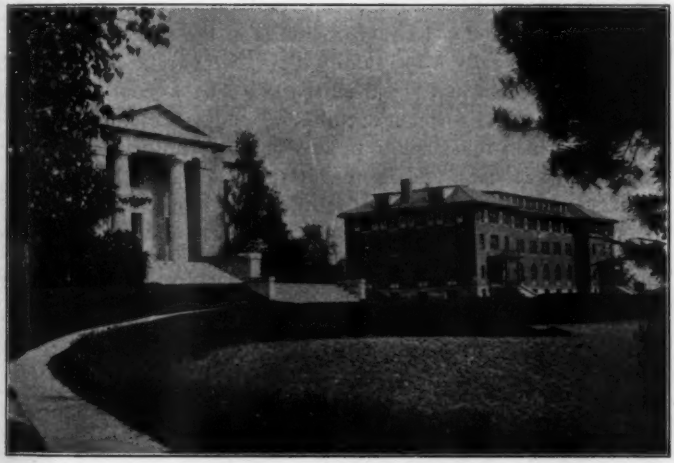
The administrative offices of the university are found in Alumni Hall, which is so called because part of the funds required for its erection were subscribed by the alumni of the university. This building also contains a general assembly room and a gymnasium, both of which long since proved inadequate to accommodate the entire student body.

ALUMNI HALL.

A new Memorial Gymnasium-Armory is being erected as the gift of the alumni and friends of the university, and the Field House unit, one of the largest of its kind in the country, has already been completed, furnishing ample space for athletic and military training during our justly famous Maine winters. The remainder of the building will be erected as soon as the subscription funds become available.

During the Commencement exercises of last year a feature

of Alumni Day was the inauguration of an alumnus of the old Maine State College as the seventh president of the University of Maine. Dr. Harold S. Boardman was a member of the class of 1895 and has had an almost unbroken connection with the institution since as instructor, professor of Civil Engineering, and for many years Dean of the College of Technology previous to his appointment as president. He is entirely familiar with the history, traditions, and ideals of his Alma Mater and we are hopefully starting in on a third period of peaceful prosperity.



His place in the College of Technology has been taken by Dean Paul Cloke who was for many years professor of Electrical Engineering in the University of Arizona.

The university is known on the air as WGBX, a broadcasting station of 500 watts power being maintained by the department of Electrical Engineering, and a program of timely talks given on Wednesday evening of each week.

There is an active branch of the S. P. E. E. here, about two thirds of the technology faculty being included in its member-

ship, and monthly meetings are held to discuss the questions proposed by the Board of Investigation and Coordination.

The university is located at a considerable distance from the large commercial centers, which places a handicap upon its engineering activities. To partially offset this it has been the custom to urge faculty members to make frequent trips and to form outside connection, for which purpose a fairly liberal travel allowance is made. A successful effort is also made to have prominent educators and professional men come to the institution and talk to both students and faculty.

The institution is not a city college but is distinctly in a country environment. While this results in certain handicaps there are also many desirable features in the situation. The institution is really a big family, furnishing in large part its own amusements and social activities. The women students are housed in two small dormitories and a Practice House while the men find shelter in two large dormitories, sixteen Fraternity Houses, and in the private houses of the nearby villages, braving the winter weather in "sheep-skins" and moccasins more frequently than in the coon-skin coats and flapping overshoes of the more sophisticated educational centers.

"ON TO MAINE."

For the aid and encouragement of any who may be contemplating going by automobile to attend the S. P. E. E. Convention which is to be held at the University of Maine in June, the following information is supplied.

Up to about 1915 the State of Maine gave very little attention to permanent highway construction. During the past ten years, however, there has been considerable activity and it is now possible to reach the principal points of the State over excellent trunk line roads. If one comes into the State from the south by way of Boston and Portsmouth, New Hampshire, he enters upon a concrete road second to none, and proceeds over hard surfaced roads without a break until he reaches the campus at Orono. If one is interested in coming to Orono by automobile,—and we hope that many will be—he should consult one of the published automobile guide books. It should be remarked, however, that there are a number of attractive entrances into the State as follows:

1. That already referred to by way of Boston and Portsmouth, continues over what is called the Atlantic Highway. If one does not care to follow the entire Atlantic Highway but wishes to come more directly to Orono, by way of Augusta, the State capital, he should branch off at Brunswick.

2. Another very beautiful point of entrance is to come from the west through the White Mountains. It is nearly a straight line from Gorham, New Hampshire, to Orono. In general this route does not follow a trunk line but is across country; therefore, a number of short stretches will be found a little rough but it is entirely passable and the country is well worth seeing. It takes one across the three big watersheds of the State, the Androscoggin, the Kennebec, and the Penobscot.

3. If one desires to take more time he may pass through the White Mountains and take a road directly to Portland or

to Poland Springs and from either place meet a trunk line running directly to Orono.

4. Another interesting entrance into the State is by way of Canada. The Jackman route is very picturesque. One usually comes from Quebec in entering the State at this point. Jackman is located about fourteen miles from the border and is the port of entry. From Jackman one travels through forests for about thirty miles until he comes to the confluence of the Dead and Kennebec Rivers. The beautiful Kennebec valley is then followed for many miles until one of the trunk line roads is met which leads the traveller out of this valley into that of the Penobscot to Orono.

5. If one desires to take a longer trip he can do so by leaving Quebec, following the St. Lawrence to Riviere du Loup, from there to Woodstock, crossing into Maine at Houlton and coming down to Orono from the north.

6. Notice has already been given of the invitation of Dean Votey of the University of Vermont. He has invited all those who care to do so and especially those, coming from West of New England, to assemble at the University of Vermont to organize before reaching Orono. The University of Vermont plans to give a dinner to those guests and will assist them in finding lodging for the night. The next morning Dean Votey will head the caravan and conduct them by the base of Mt. Mansfield, through historic Smugglers' Notch, from there to St. Johnsbury, Vermont, to Bethlehem, New Hampshire, through the White Mountains to some point to be decided upon later where the night will be spent, proceeding the next day to Orono. This is a trip well worth while taking in the beauties of the country around Burlington and Lake Champlain, the Green Mountains of Vermont, the White Mountains of New Hampshire, and the forests, rolling country and historic towns of Maine.

It is planned to furnish those who may care to do so an opportunity to view some of the beauties of Maine. We cannot offer the grandeur of the Rocky Mountains, or the expanse of the Mid-western prairies; but the State of Maine has

a beauty all its own furnished by its many miles of indented coast line, its forests, its lakes, streams and rivers, and its Mt. Katahdin region. Maine has been called a vacation state and certainly the facilities provided furnish one with many opportunities so that he should be able to find something to his liking. Within seventy-five miles of Orono is located to the north, Moosehead Lake, a body of water forty miles long in addition to almost countless smaller lakes, all of which are rich in fishing possibilities. To the south, only forty miles away is the Atlantic Ocean and famous Bar Harbor located upon Mt. Desert with its picturesque mountainous scenery. Further to the north and to the east is the much noted Aroostook County, famous for its potatoes. To those who come from the Mid-western states with their big farms, a trip through Aroostook would be of interest.

To those who play golf attention should be called to the Penobscot Valley Country Club located within two miles of the University. The Club is supported by the surrounding communities, principally by the City of Bangor, seven miles away. The eighteen-hole course located at the Club is known far and wide as being an exceptionally fine one.

For all those who desire to camp out while here good facilities will be provided. It is expected, however, that most of the guests will desire to live in the dormitories where they can be together.

CURRICULUM REVISION IN THE LIGHT OF THE BOARD'S RECOMMENDATIONS.

BY W. E. WICKENDEN,

Director of Investigation.

The Preliminary Report of the Board of Investigation and Coordination includes a group of suggestions and recommendations concerning curricula. The Staff has been examining some of the specific problems involved in giving effect to these proposals and has embodied some of its ideas *provisionally* in a schematic group of curricula and certain notes which are now set forth to stimulate study and discussion. It will be understood that this material is unofficial and is not intended as actual recommendations for specific situations. The Staff invites comment, criticism and suggestions.

General Features.—The following may be noted:

1. The five principal curricula of widest occurrence are covered.

2. The curricula are set up in two distinct stages, each containing both technical and humanistic subjects. The first stage aims to provide good foundations, a reasonable trial of engineering interest and aptitude, and a fair quota of directly serviceable training so that the end of the first stage may be a suitable terminal point or a point of transfer to other educational programs for those who, for any reason, do not continue the study of engineering in its professional sense.

3. An alternative second year is sketched for four of the curricula to supply a terminal program of distinctly practical value for students not intending to continue further.

4. There is no significant differentiation of curricula in the first year. Differentiation in the second year is with respect to one subject only. The large proportion of work in common enables the student to defer his final choice and to correct a provisional one without undue complication. The entire

first stage is set up so as to facilitate sectioning of classes to accord with significant differences of preparation, ability, and pace.

5. The preparation assumed is fifteen units, including three in mathematics. Where higher entrance requirements in mathematics are maintained, the time in the curriculum devoted to this subject may be reduced, if desired, and other subjects increased proportionately.

6. A total of seventeen credit-hours in addition to physical and military training and not more than five distinct divisions of instruction are included in each period. Laboratory, drafting room, shop, and field instruction is understood to be included in the time assignments, wherever appropriate. The division of time between clock hours of instruction and preparation is purposely left discretionary, but a total of three hours of effort for each credit-hour is assumed.

7. A summer term of four weeks or more, preferably at the end of the second year, is proposed for each curriculum. Considering each week's work as equivalent to a semester credit unit, the summer term raises the total semester credit-hours for each curriculum to 140 or 142.

8. A band of humanistic studies, equivalent to three credit-hours, extends throughout each curriculum. English and economics are included as required subjects in the first stage because of their universal values and to make it practicable for students who have completed the first stage to transfer to programs in business administration. In the advanced stage, an alternative is offered between two years of modern language and an additional year of English, followed by a year of history and government.

9. The time allotments for group options in the fourth year are not subdivided, in order to allow considerable latitude in working out both technical and administrative combinations.

10. Fragmentary courses, too brief for a fair introduction to the subject, are avoided.

11. Directly or indirectly, all the subjects recommended by the Board for inclusion in all curricula are provided for.

12. The type of program suggested conforms substantially

to the recommendations of the conference of Mid-west deans held in 1922 and reported in the *Proc. S. P. E. E.*, Vol. XXX, page 170.

Notes on First-Year Courses.—Chemistry includes lectures, recitations, and laboratory exercises. Graphics includes both drawing and descriptive geometry. English deals principally with composition and speech. Students provisionally anticipating civil or mining engineering would normally elect surveying in the second semester. Selective sectioning is advised in all first-year courses, unless selective admission methods assure comparative homogeneity of classes.

SCHEMATIC CURRICULUM.

INTRODUCTORY STAGE, 2 YEARS.

	Credits	
	Semester First.	Second.
FIRST YEAR, in Common:		
Mathematics	5	5
Inorganic Chemistry	4	4
Graphics	3	3
English	3	3
Shop or Surveying *	2	2*

* Option in second semester.

SECOND YEAR:	CIVIL.		ELEC-TRICAL.		ME-CHAN-ICAL.		CHEM-ICAL		MINING.	
Mathematics	4	4	4	4	4	4	4	4	4	4
Physics	5	5	5	5	5	5	5	5	5	5
Chemistry							4	4	4	
Geology										4
Economics	3	3	3	3	3	3	3	3	3	3
Mechanism and Design			4		4					
Surveying and Plotting	4									
Mechanics		4		4		4				
Lab. Technology or Eng. Problems	1	1	1	1	1	1	1	1	1	1

REQUIRED SUMMER TERM, 4 TO 6 WEEKS:

Surveying.....Civil Engineering Curriculum
Shopwork.....Mechanical Engineering Curriculum
Introd. Elec. Eng.....Electrical Engineering Curriculum
Introd. Chem. Eng.....Chemical Engineering Curriculum
Mine Surv. (2), Geol. and Mineral. (4)
Mining Engineering Curriculum

ADVANCED STAGE, 2 YEARS.

THIRD YEAR:	CIVIL.		ELEC-TRICAL.		ME-CHAN-ICAL.		CHEM-ICAL.		MINING.	
Math., Phys., Chem., Biol. or Geol	3		3		3		†	†	3	
English or For. Language	3	3	3	3	3	3	3	3	3	3
Mechanics and Materials	4	4	4	4	4	4	4	4	4	4
Hydraulics		4.5					2			
Heat Power	4.5		3	4.5	†	†	3	4.5	4.5	
Electric Power			†	†	3	4.5				
Major Eng. Subject	2.5	5.5	4	5.5	4	5.5	5	5.5	2.5	7.0
FOURTH YEAR:										
For. Lang., Hist. and Gov., or other general studies	3	3	3	3	3	3	3	3	3	3
Electric Power	4.5		†	†			4.5		4.5	
Hydraulics			4		4				2	
Major Eng. and Adm. Subj's. (group options)	9.5	14	10	14	10	14	9.5	14	7.5	14

OPTIONAL GRADUATE YEAR.

Science or Economics	4 to 6	4 to 6
General non-technical study	0 to 3	0 to 3
Engineering and administrative subjects and research	13 to 9	13 to 9

Notes on Second-Year Courses.—Physics includes lectures, recitations, and laboratory exercises. Chemistry deals principally with analysis and includes laboratory work. Economics includes one semester of general principles and one semester on the functional organization of industrial society, under such divisions as the exploitation of minerals, manufacturing, transportation, power supply, communication, public works, finance, risk-bearing, marketing, and the like. Mechanics is intended to be a foundation technical subject and would be taught from the physical point of view. Laboratory technology is a course rotating through the principal laboratories and devoted to the technical measurement of the commoner engineering quantities, with a three-hour period per week under supervision. Selective sectioning is advised in all second-year courses.

† Included in major engineering subject.

Notes on Third-Year Courses.—Science options would include differential equations and their applications, modern theory of matter and energy, general geology, and general biology. Modern language option includes German, French, and Spanish, the subject chosen to be continued through two years by a beginner and through one year in case of considerable preparation. The English option deals principally with literature and discussion. Mechanics, heat power and electric power include laboratory work. Heat power is included in the major engineering subject of mechanical engineers and electric power in that of electrical engineers. Hydraulics includes laboratory work for civil engineers.

Notes on Fourth-Year Courses.—The foreign language option is a continuation of that in the third year. The course in history and government deals with modern institutions as affected by science, invention, industrial expansion, world trade, economic geography, and population pressures, and with government as a form of collective economic effort and control. Engineering economy is to be taught in connection with the engineering subjects proper. Group options provide for a completion of engineering principles and methods in some one distinctive division of technical or administrative activity. The following are illustrative of the types of group options which might be offered in the fourth year:

Under Civil Engineering: Structural Engineering, Transportation, Sanitary Engineering, Water Power, Municipal Engineering, City Management, etc.

Under Electrical Engineering: Electrical Machinery, Communication, Power Supply, etc.

Under Mechanical Engineering: General Machinery, Heat Power, Automotive Engineering, Heating and Ventilation, Industrial Engineering, etc.

Under Chemical Engineering: General Option, Fuel Option, Metals Option, etc.

Under Mining Engineering: Metal Mining, Coal Mining, Petroleum Production, Petroleum Refining, Metallurgy, Engineering Geology, etc.

Notes on Alternative Second Year.—The work is intended to be of value to men of good general ability who lack time, means or analytical interest required by the four-year course, and who wish a directly serviceable training to qualify them as technicians, supervisors of industrial processes, or assistants to engineers. A fairly high ratio of contact hours to hours of preparation is probably appropriate, making of the year's work something to do rather than something abstract to study.

SECOND YEAR TERMINAL PROGRAM FOR CERTIFICATE.

	CIVIL.		ELEC-TRICAL.		MECHAN-ICAL.		CHEM-ICAL.	
Technical Mathematics	4		4		4		4	
Physical Elements of Eng.	4	4	4	4	4	4	4	4
Economics	3	3	3	3	3	3	3	3
Field Measurements	2							
Maps and Plans		2						
Mech's, Mat's, and Constr'n	3	6				3		
Mechism and Machine Elements			3		3			
Elec. Circuits and Machines			2	6				
Machine Drawing and Design or Power Machinery						3		
Chemical Analysis							3	3
Ind. Chem. Lab							2	2
Chemical Machinery and Processes								3
Shop Technology				2	2	2		
Laboratory Technology	1	2	1	2	1	2	1	2

Comparisons with Present Curricula.—Comparisons between the curricula suggested, the average present requirements and the details of the curricula in five representative institutions appear in the accompanying tables. It is plain that the scheme suggested tends to lighten the total requirements, raise the humanistic requirement above present average levels, and maintain or extend the more general scientific and technological foundations, at the expense of the number and variety of the courses in engineering applications.

The issue between simple curricula made up of a small number of general items and with low totals of credit and contact hours, and more complex curricula of many specific items and high contact hour requirements is too involved for adequate

analysis in this memorandum. There are grounds for assuming that the two have different aims, one stressing the development of the student's innate thinking powers and the development of his mental independence, and the other seeking to give the student the largest possible specific technical training in a given period. It also seems true that the two plans fit different environmental conditions, in one case favorable to a considerable measure of independent work and in the other making it wise to have the student do his work largely under supervision. Both types have notable exemplars and both have produced worthy results. While it would probably be unwise to have all institutions go to either extreme, progress seems to lie, for the most part, in the direction of simpler and more general programs.

COMPARISON BETWEEN SUGGESTED AND PRESENT AVERAGE GROUP AND TOTAL REQUIREMENTS.

	CIVIL.		ELECTRICAL.		MECHANICAL.		CHEMICAL.		MINING.	
	Suggested.	Average.	Suggested.	Average.	Suggested.	Average.	Suggested.	Average.	Suggested.	Average.
Humanistic, etc.	24	18.25	24	19.35	24	18.5	24	20.35	24	16.85
Scientific	39	41.2	39	39.5	39	38.4	44+	48+	54	54.9
General technology	35.5	34.9	39.5	41.6	31.5	35.8	34	32.4	31	29.8
Major engineering subject	41.5	45.5	37.5	36.7	45.5	44.6	38−	37.1−	33	36
Technical electives		5.5		6		6.1		6.5		6.5
Total non-engineering	63	59.45	63	58.85	63	56.9	68+	68.35+	78	71.75
Total engineering	77	85.9	77	84.3	77	86.5	72−	75.9−	64	72.3
Grand total	140	143.35	140	143.15	140	143.4	140	144.25	142	143.05

+ and − signs indicate that additional science (chemistry) is included in the time assigned to the major engineering subject.

Specialization.—The above statements apply with equal force to the matter of specialization. Differentiation to admit of a number of groupings of equally general sciences and

basic engineering principles is one thing and specialization which aims to prepare men for specific types and fields of practice is another. The scheme suggested provides for the building up of a fairly complete sequence of the basic principles which underlie each major division of engineering and for a moderately extended illustration of the application of these principles to some *one* type of engineering activity. The effect should be almost wholly cumulative in character. The flexibility afforded by possible concentration groups in the final year seems ample for the great majority of cases. There are many students who want a specialized training, are perfectly willing to sacrifice whatever broader educational advantages are necessary to get it, and are entitled to have it. It is probably desirable and necessary that certain institutions should choose to serve principally such men. It seems probable, however, that adequate concessions have already been made to these needs and that progress lies away from larger specialization rather than toward it. An optional graduate year is suggested as the normal time for real specialization.

Humanistic Content.—It seems advisable, probably necessary, that the humanistic section should not offer a random sampling of cultural matter, but should be ordered with a view to the engineer's functional interests and duties in society. This conception has controlled the selection and arrangement of the humanistic band which runs through the suggested curricula.

Foreign languages are placed on an optional basis and deferred to the advanced stage of the curriculum for a number of reasons. It is felt that they should be studied purposefully or not at all. Election by upper-classmen contributes to this end. The pursuit of foreign languages by students who do not continue beyond the second year is of doubtful value, while the study of English and economics is of universal value in all grades of technical activity.

The suggested senior course in history and government aims to acquaint the student with the dynamic forces which are shaping present-day society, and particularly the social consequences of scientific and technological progress.

COMPARISON OF SUGGESTED CURRICULA AND THOSE OF FIVE INSTITUTIONS.

	CIVIL ENGINEERING.						ELECTRICAL ENGINEERING.					
	Suggested.	M. I. T.	Cornell.	Penn. State.	Purdue.	Wisconsin.	Suggested.	M. I. T.	Cornell.	Penn. State.	Purdue.	Wisconsin.
English	6–12	10.7	6	10	12	10	6–12	13.3	4	10	12	6
Foreign language	0–12			8	0–6		0–12			8	0–6	
Economics	6	4	5	6	3	3	6	4	3	9	3	4
History and government	0–6	*a*		6	3–6		0–6	*a*	4	3	3–6	
Humanistic electives	0–6	5.3	0–9		6–12		0–6	2.7	4		6–15	15–22
Mathematics	18	12	11	16	20	18	18–21	14	11	16–18	20	18
Chemistry	8	8.7	6	8	5.3	8	8–11	8.7	8	6	5.3	8
Physics	10	12	6	8	8.7	10	10–13	12	14	8	14.7	12
Geology and mineralogy	(3)	3	3	5	2	3						
Other sciences	(3)	2.3	2				(3)					*b*
Graphics	6	7.4	13	8	6		6	7.1	11	6	6	6
Shopwork	2		2				2–4	2.7	6	5	8	4
Mechanism and elem. des.		2					4	3	6	4		4
Surveying	9–11	11.6	14	14	12	16	0–2	1.7	3	1		3
Mechanics and materials	12	11.3	18	11	11	14–16	12	7.3	14	10	8.7	12
Hydraulics	4.5	3	4	3	4.3	4	4	3	3	2		3
Heat power	4.5	6.3	3	3	4.3	4	7.5	7.7	14	10	10	8
Electric power	4.5	4.7	4	4	4	4	*c*	*c*	*c*	*c*	*c*	*c*
Structures	*c*	*c*	*c*	*c*	*c*	*c*						
Machine design									4			
Metallury												
Engineering electives			9		6						9	7
Major group of engineering and administrative subjects	31.5	31	42–51	38	45.7–51.7	53–55	33.5	40	41	38	34.7–43.7	40–47

a. Included in other subject. *c*. Included in major subject.
b. Included in electives. ( ) Denotes included in options.

COMPARISON OF SUGGESTED CURRICULA AND THOSE OF FIVE INSTITUTIONS (continued).

	MECHANICAL ENGINEERING.						CHEMICAL ENGINEERING.						MINING ENGINEERING.					
	Suggested.	M. I. T.	Cornell.	Penn. State.	Purdue.	Wisconsin.	Suggested.	M. I. T.	Cornell.	Penn. State.	Purdue.	Wisconsin.	Suggested.	M. I. T.	Cornell.	Penn. State.	Purdue.	Wisconsin.
English	6–12	10.7	6	10	12	10	6–12	13.3	4	10	12	6	6–12	13.3	4	10	12	6
Foreign language	0–12			8	0–6		0–12			8	0–6		0–12			8	0–6	
Economics	6	4	5	6	3	3	6	4	3	9	3	4	6	4	3	9	3	4
History and government	0–6	*a*		6	3–6		0–6	*a*	4	3	3–6		0–6	*a*	4	3	3–6	
Humanistic electives	0–6	5.3	0–9		6–12		0–6	2.7	4		6–15	15–22	0–6	2.7	4		6–15	15–22
Mathematics	18	12	11	16	20	18	18–21	14	11	16–18	20	18	18–21	14	11	16–18	20	18
Chemistry	8	8.7	6	8	5.3	8	8–11	8.7	8	6	5.3	8	8–11	8.7	8	6	5.3	8
Physics	10	12	6	8	8.7	10	10–13	12	14	8	14.7	12	10–13	12	14	8	14.7	12
Geology and mineralogy	(3)	3	3	5	2	3												
Other sciences	(3)	2.3	2				(3)					*b*	(3)					
Graphics	6	7.4	13	8	6		6	7.1	11	6	6	6	6	7.1	11	6	6	6
Shopwork	2		2				2–4	2.7	6	5	8	4	2–4	2.7	6	5	8	4
Mechanism and elem. des.		2					4	3	6	4		4	4	3	6	4		4
Surveying	9–11	11.6	14	14	12	16	0–2	1.7	3	1		3	0–2	1.7	3	1		3
Mechanics and materials	12	11.3	18	11	11	14–16	12	7.3	14	10	8.7	12	12	7.3	14	10	8.7	12
Hydraulics	4.5	3	4	3	4.3	4	4	3	3	2		3	4	3	3	2		3
Heat power	4.5	6.3	3	3	4.3	4	7.5	7.7	14	10	10	8	4.5	7.7	14	10	10	8
Electric power	4.5	4.7	4	4	4	4	*c*	*c*	*c*	*c*	*c*	*c*	4.5	4.7	4	4	4	4
Structures	*c*	*c*	*c*	*c*	*c*	*c*							*c*	*c*	*c*	*c*	*c*	*c*
Machine design									4									
Metallury																		
Engineering electives			9		6						9	7			9		6	
Major group of engineering and administrative subjects	31.5	31	42–51	38	45.7–51.7	53–55	33.5	40	41	38	34.7–43.7	40–47	31.5	31	42–51	38	45.7–51.7	53–55

a. Included in other subject. *c*. Included in major subject.
b. Included in electives. ( ) Denotes included in options.

	31.5	31	42–51	38	45.7–51.7	53–55	33.5	40	41	38	34.7–43.7	40–47				

a. Included in other subject. c. Included in major subject.
b. Included in electives. ( ) Denotes included in options.

COMPARISON OF SUGGESTED CURRICULA AND THOSE OF FIVE INSTITUTIONS (continued).

	MECHANICAL ENGINEERING.						CHEMICAL ENGINEERING.					MINING ENGINEERING.			
	Suggested.	M. I. T.	Cornell.	Penn. State.	Purdue.	Wisconsin.	Suggested.	M. I. T.	Penn. State.	Purdue.	Wisconsin.	Suggested.	M. I. T.	Penn. State.	Purdue.
English	6–12	10.7	4	10–13	12	6	6–12	10.7	12	9	6	6–12	10.7	9–12	6
Foreign language	0–12			8	0–6		0–12	5.3	12	12–15		0–12		6–9	
Economics	6	4	3	6	3		6	4		3		6	4	3–6	7
History and government	0–6	*a*	4	3	3–6		0–6			3		0–6	*a*	0–6	
Humanistic electives	0–6	5.3			6–18	3	0–6	4	3		0–10	0–6	4		
Mathematics	18–21	12	11	16	20	18	18	11	14	20	18	18	12	14	18
Chemistry	8–11	10	8	6	5.3	8	16*d*	36	45	40–50	22	12	17.7	15	13
Physics	10–13	12	14	8	9.3	10	10	12	13	15	10	10	12	8	8
Geology and mineralogy	(3)									0–3		14	12	15	24
Other sciences	(3)									2					
Graphics	6	8.4	11	7	6	9	6	4.4	2	4	6	6	4.4	4	9
Shopwork	8	6.3	7	6	8	10	4			4	4	2	.7		4
Mechanism and elem. des.	4	5	6	4	3.3	5		2		0–2	4		2		
Surveying	(2)	.7	3				(2)			.7		4	8	3	2
Mechanics and materials	12	17	14	12	9.7	14	8	6.7	8	8.7	12	8	6.8	8	12
Hydraulics	4	3	2	3	4	3	2		2			2	1.7	3	
Heat power	*c*	*c*	*c*	*c*	*c*	*c*	7.5	7.3	2	7	9	4.5	6.3	3	6
Electric power	7.5	4.7	10	8	7.3	10	4.5	5	8	8	6	4.5	5.0	6	6
Structures												*c*	1.7		4
Machine design	*c*	*c*	*c*	*c*	*c*	*c*									
Metallurgy									4	0–6		*c*	*c*	*c*	*c*
Engineering electives								3			10				
Major group of engineering and administrative subjects	33.5	27	55	42–45	43.7	55	34*d*	20–33	14	8–11	37–47	29	26.5	44	37

a. Included in other subject. *d*. Includes additional chemistry.
c. Included in major subject. ( ) Denotes included in options.

VARIATION OF GRADES IN THE SCHOOL OF ENGINEERING, OREGON AGRICULTURAL COLLEGE.

BY B. B. BESSESEN,

Instructor in Electrical Engineering.

From time immemorial the battle has been waged over the question of correctly judging one's ability and success. As the child chooses his playmates and the business head finds his associates, so the teacher judges or grades his students, each one finds certain attachments for an individual which frequently prejudices or warps his judgment. When we realize the differences in individuals and therefore their judgment it is no wonder that estimates vary.

The individual, whether he be a business man, teacher, or student, may be kind-hearted and sympathetic or cynical and hard-boiled. These factors cannot help but influence human reactions. The teacher has all these factors and many more to fight against, both with himself and the student, when making out a grade. Any rating system introduces at least two variables—a varying standard of student excellence and a varying standard of teacher excellence. Thus one's grading may unconsciously be inconsistent. Equitable grading of all students of the departments within an educational institution and the comparison of the grading of one institution with another is beginning to be worked out on a scientific basis. The elementary and secondary schools have done a lot of testing of native ability of their pupils but the colleges and universities who were instrumental in initiating these tests, with a few exceptions, have not done much.

Under the general subject of grading, the first thought that occurs to one is on what basis should the grading be done? Should it depend on future success in life or should it depend on intellectual work? While it no doubt would be of inestimable value to be able to predict the chances of one's success in one vocation over some other in later life, the contact

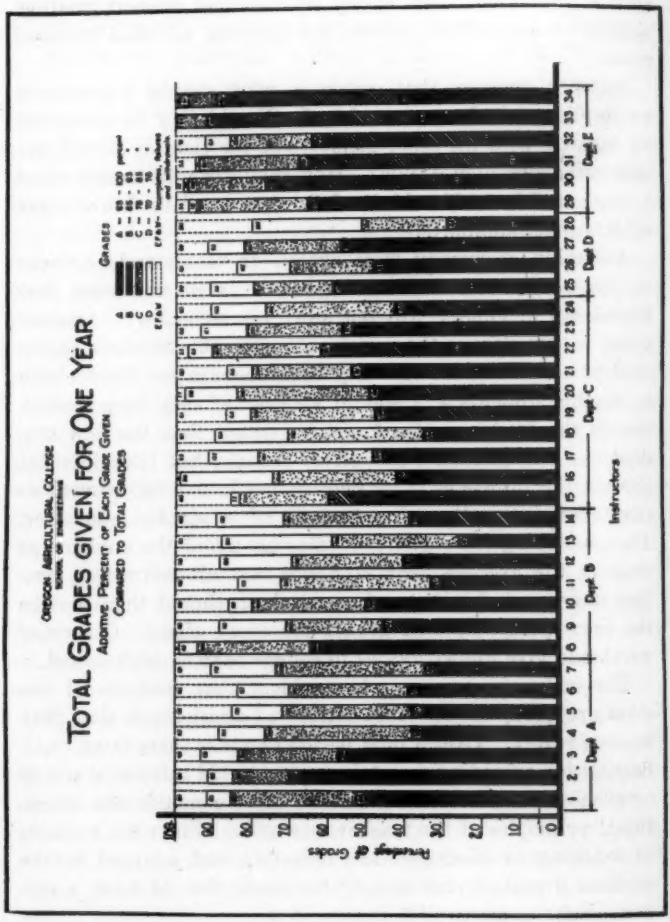
an instructor has with the average student hardly warrants such a prediction. The writer believes that student grading should be done directly from the problem at hand in most cases.

Another question that occurs is what should a student's accomplishments be measured by? Should they be measured by ranking with the other members of the class or should the instructor's opinion decide? How should we determine when a student fails? Should he fail when he falls below some arbitrary set standard?

Assuming everybody were agreed on this standard, have we any assurance that an instructor is so unhuman that friendship or enmity will not sway his estimates? Another point is how close is the registrar's office able to measure the student's credentials? If they issue registration blanks only to eligible students why should we hear of such large casualties in the freshmen class? It is granted that the new student can not acclimate himself so readily, but that does not explain the failure of large percentages in one department as compared with other departments of a similar character. Then assuming the registrar's office has rated the students as close as the average instructor and that all instructors outline their work for the medium student, should there not be the same percentages of grades for every class? Otherwise we should give higher grades in college than in high school.

The instructor may say by accident that students of one class are good, but the very nature of accidents is that they happen rarely. Over a long period of years there is no justification for exceeding a certain per cent. If inferior students or even some medium ones fail we must conclude the educational principles of the teacher unsound. Either his methods of teaching or discipline are defective and adapted to the medium group of students, or his conception of what a student ought to accomplish is one-sided.

With the idea in mind of determining just how much individual differences affect the instructor's grades, a detailed study of grading has been made in the School of Engineering at Oregon Agricultural College during the past year.


OREGON AGRICULTURAL COLLEGE
TOTAL GRADES GIVEN FOR ONE YEAR
ADDITIVE PERCENT OF EACH GRADE GIVEN
COMPARED TO TOTAL GRADES
GRADES
Percentage of Grades
Dept A
Dept B
Dept C
Dept D
Dept E
Instructors

Permanent records were consulted and the distribution in percent of each grade given by every instructor in the school of engineering compared to his total number of grades was determined. A comparison of one department with another

TABLE I.

PERCENTAGE OF ALL GRADES GIVEN BY EACH INSTRUCTOR FOR ONE SCHOOL YEAR AT THE ENGINEERING SCHOOL—OREGON AGRICULTURAL COLLEGE.

Instr.	Class.	Grades	Ave.	A	B	C	D	E	F	Inc.	W.
1	Fresh.	284	83.75	10.6	41.9	32.8	6.3	3.9	1	2.5	1
2	Soph.	117	86.55	31.6	38.5	14.5	6.8	2.6	3.4	0.0	2.6
3	Senior	328	84.06	17.4	39.7	26.3	9.8	3.4	2.2	1.2	0.0
4	Senior	156	81.15	7.0	30.8	38.5	12.2	6.4	2.5	1.3	1.3
5	Soph.	*85	80.90	10.6	27.1	34.1	13.0	4.7	3.5	3.5	3.5
6	Fresh.	517	81.40	4.1	34.8	31.2	13.7	4.4	1.9	0.6	9.3
7	Junior	128	80.92	7.8	26.6	39.0	17.2	3.1	1.6	4.7	0.0
8	Senior	286	86.43	21.3	43.0	29.7	4.9	0.0	0.0	1.1	0.0
9	Jr.-Sr.	237	82.20	11.4	34.2	25.3	17.3	5.5	2.1	0.8	3.4
10	Senior	100	83.55	17.0	33.0	30.0	6.0	1.0	0.0	13	0.0
11	Junior	151	80.30	8.0	25.1	39.1	11.3	4.0	3.3	8.0	1.3
12	Fresh.	287	80.50	11.9	28.2	29.3	18.8	1.7	7.7	0.0	2.4
13	Fr.-Jr.	82	77.95	7.3	18.3	33.0	29.3	2.4	8.6	0.0	1.1
14	Soph.	179	81.80	10.0	28.5	33.0	17.9	6.7	0.0	1.1	2.8
15	Senior	184	85.75	31.5	28.3	23.4	2.2	1.1	0.0	13	0.5
16	Seniot	98	83.20	15.3	26.5	32.6	24.6	0.0	0.0	0.0	1.0
17	Junior	83	83.12	20.5	27.7	30.1	13.2	3.6	2.4	2.4	0.0
18	Soph.	165	81.89	10.3	24.4	35.8	19.4	1.8	4.9	3.6	1.8
19	Fresh.	122	84.75	18.0	29.5	32.8	6.6	0.0	0.0	5.7	7.4
20	Junior	138	84.06	18.8	30.4	34.8	13.8	0.7	1.5	0.0	0.0
21	Fresh.	106	83.30	22.6	31.1	26.4	6.6	1.0	6.6	2.8	2.8
22	Jr.-Sr.	94	86.34	27.7	34.1	28.7	6.3	2.1	0.0	1.1	0.0
23	Soph.	91	85.30	25.3	30.7	25.3	12.1	1.1	1.1	1.1	3.3
24	Fresh.	76	82.25	21.0	21.0	34.2	14.5	0.0	6.6	0.0	2.7
25	Junior	132	84.50	23.5	34.8	21.3	11.4	0.8	3.8	2.2	2.2
26	Junior	162	83.20	16.0	31.5	22.2	14.2	1.9	3.1	8.0	3.1
27	Junior	105	84.75	25.7	30.5	25.7	9.5	3.8	1.9	1.9	1.0
28	Junior	169	76.82	11.8	16.6	22.0	29.5	3.0	13.6	0.0	3.5
29	Fresh.	165	86.79	26.7	38.2	29.7	1.8	1.2	0.0	2.4	0.0
30	Fresh.	240	87.88	27.5	38.7	20.8	0.8	0.0	0.8	0.4	0.8
31	Fresh.	176	85.90	12.5	55.1	26.1	1.1	0.0	0.6	2.3	2.3
32	Fresh.	314	85.70	19.7	44.0	22.0	6.4	0.0	0.0	1.6	6.4
33	Fresh.	†36	90.20	36.1	55.6	8.3	0.0	0.0	0.0	0.0	0.0
34	Fresh.	103	90.42	40.8	48.5	9.7	1.0	0.0	0.0	0.0	0.0

* Two term's grades.
† One term's grades.
Withdrawals (W.) are not included in averages.
For calculating averages grades were weighted as follows:

A = 96	C = 80	E = 65	Inc = 70
B = 88	D = 74	F = 50	

A grade of 70 is passing.

was also made. Data from five departments and 34 instructors were used. The time was over three consecutive terms or one regular school year. From this, each instructor's average and the per cent of each grade given was calculated as shown in Table I. The graph shows similar data in a very striking manner.

One cannot help but appreciate the irregularity of the curve at a glance. It would seem that when the instructors have the same students there should be good grade correlation. Referring to table I again, it is noted that the same freshmen have a maximum variation of approximately nine per cent between averages of instructor number 6 and instructor number 34. The later instructor has ten times as many A's as the former. Similar variations, though not as large, appear with other classes. The variations also exist between departments as shown by the curve. Does not this indicate an inconsistency in standards for grading?

The writer has used several kinds of objective tests and graded by rank with good results. In making up tests of achievement they should be objective as far as possible and of high reliability instead of subjective. When grading by rank each student is compared with all other students in his class of equal caliber. By this method of grading the incentive to "work" the instructor is removed and partiality charges are avoided. After one has made out his grades he can check their distribution for irregularities. If the classes are small the comparison may have to be made with students in another class. The results of such tests show that the engineering school grades compared very favorably with the average for the college and show results similar to that which can be found in any school.

The presentation of such facts has a healthy influence on grade distribution. Though these are all well known facts, occasional discussion of this information has a rejuvenating influence on the situation.

The writer believes that average classes of students doing honest work and marked equitably, will yield results which

when tabulated should conform to the normal probability curve; *i.e.*, the number receiving medium marks should far exceed the number receiving high or low marks. One authority says: "The tendency in all institutions is to mark too high because of the democratic tendency of many instructors to place so large a proportion of students in the distinguished class."

HIGH SCHOOL SCHOLARSHIP STANDING OF FRESHMAN ENGINEERING STUDENTS.

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AND

PAUL M. THORNBURG,

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It has long been known that self-estimates are not always trustworthy. Moreover, recent experimental studies enable us to generalize by stating that self-estimates tend toward: (1) over-estimation of desirable qualities, and (2) under-estimation of undesirable qualities.[1] In view of this knowledge, it is rather surprising to note that the Committee on Engineering Students and Graduates relied upon the method of self-estimates in obtaining information concerning the mental calibre of engineering freshmen upon entrance to college. Reference is made here to the questionnaire filled out by entering freshmen relative to their high school standing.

The tabulation of the returns on this item showed that 18.0 per cent of engineering freshmen claim to have been honor students in high school, an additional 42.6 per cent claim to have been in the upper third of the graduating classes, 36.8 per cent claim to have been in the middle third, and only 2.6 per cent admit having been in the lower third.[2] The published report interprets the data as follows: "From these it appears that engineering colleges are receiving considerably better than an average selection in point of mental ability. From the students' statements it appears that 60 per cent

[1] H. L. Hollingworth, "Judging Human Character," D. Appleton Co., 1923, pp. 45–60.

[2] "Engineering Students at Time of Entrance to College," J. of ENGINEERING EDUCATION, Sept. 1926, p. 88.

were in the honor group or upper third of high school graduating classes, and that but 2.6 per cent were in the lowest third. *These statements have been confirmed in certain cases by examination of records obtained directly from high schools.*" (Italics as in original quotation.) Continuing, "It is to be noted, however, that 11.5 per cent of the students did not give their high school standing. Some of these may have failed to do so because of poor records. The returns from the colleges are remarkably uniform in the percentage of entering students of high standing. No institution reports more than a very small proportion of students drawn from the lowest third of high school classes."[3]

The report sent in by the local committee at the University of Minnesota is almost identical with that for the country as a whole. We are justified in stressing this fact because it shows that the local data are typical.

Believing that acceptance of such self-estimates at face value is likely to lead to misinterpretations, we undertook to determine the factual basis for such self-estimates here at Minnesota.

We are favorably situated for such a check-up because of the careful manner in which high school standing is determined for the Twin City high schools. In connection with extensive personnel studies, Dean Johnston, of the Arts college, has obtained from each Twin City high school a list of all graduating seniors at the end of each year.[4] This list gives for each senior an average grade based on all work done throughout the high school course. These averages are then arranged in rank order and a percentile rank assigned to each average. Thus each average grade is converted into a relative grade which shows the student's rank in a typical group of 100 seniors. We need to refer only to these percentile rankings for an unusually satisfactory check-up on the self-estimates.

[3] Op. cit., p. 89–90.

[4] J. B. Johnston, "Predicting Success or Failure in College at the Time of Entrance," *School and Society*, Vol. XIX, Nos. 496 and 497, June 28, and July 5, 1924.

The results for the classes entering engineering in 1924, 1925, and 1926 are presented in the following table:

H. S. Third.	1924.		1925.		1926.		Three Classes Combined.	
	No.	%.	No.	%.	No.	%.	No.	%.
Upper Third	29	32.2	22	38.6	26	35.1	77	34.8
Middle Third	42	46.7	25	43.8	30	40.5	97	43.9
Lower Third	19	21.1	10	17.6	18	24.4	47	21.3
Total	90	100.0	57	100.0	74	100.0	221	100.0

The discrepancy is self-evident between these figures and those quoted from the Board's report. Although the number of cases is not large, yet the figures for the three years are very consistent. Additional data from non Twin City schools giving principals' statements about the standing of their seniors were available and, if included, would have increased greatly the number of cases. These data were not included in the above tabulation because we have no assurance that the method of assigning high school rankings was the same. Had we included these data, the trend of the results would have been changed very slightly, if at all, because the percentages approximate those given above. In other words, such additional data as might be produced merely confirm but do not alter our facts. We feel justified, therefore, in concluding that the majority of entering engineering freshmen do not come from the upper third of their high school graduating classes. On the contrary, there is good reason to believe that the high school rank of seniors plays a very minor role in differentially selecting them for entrance to the engineering college. It would appear that all levels of high school graduating ability are attracted.

In view of this evidence, we are inclined to question the accuracy of the self-estimates of high school standing collected by the Board of Investigation and Coordination. The uniformity with which the large majority of engineering freshmen in various schools claimed to have been in the upper third

of their high school graduating classes merely emphasizes the universality of this tendency toward over-estimation of desirable qualities. This tendency seems to be especially pronounced among those actually in the lowest third of their classes. There seems to be a very strong resistance to admitting scholastic inferiority on the part of such students.

The discrepancy between self-estimates and actual facts, disclosed in this paper, is not presented in order to criticize or to find fault with the recent investigation of engineering education. On the contrary, it is aimed merely at a desirable re-interpretation of the data concerning the mental calibre of entering freshmen in order that the facts about student mortality need not be so perplexing. It is difficult to reconcile the published student mortality figures with the interpreted superiority of entering students. If we keep the proposed re-interpretation in mind, then the distressing combination of "high mortality" and "student superiority" tends to disappear. A larger share of the mortality can now be assigned to scholastic incompentency on the part of a large number of entering students.

THE CONFERENCES ON ENGLISH, JUNE 27, 1927.

The sixth joint conference of deans, administrative officers, and teachers of English, will be held June 27, at the University of Maine, in connection with the annual meeting of the S. P. E. E. Last June, at Iowa City, something over one hundred were present at a half-day conference preceding the opening session of the Society. The discussion of the extension of English courses by the development of elections in English Literature was full of interest and profit for us all. The prospect for a live meeting this year is even better than it was last year. The Preliminary Report of the Board of Investigation and Coordination has set before us, in a way to challenge our most careful consideration, the almost universal agreement among engineering educators as to the fundamental place of English in any ideal curriculum. When, of the thousands of opinions regarding fundamental elements in the engineering curriculum, 95.5 per cent place English Composition second only to Mathematics and Physics, there is no longer need to urge the importance of training in English. But if, as the Board has suggested, this work is to be an integral part of the education of the engineering student, correlated with the other elements in his course, and extending as a part of the band of humanistic studies throughout the four years, there are still a multitude of questions that do need to be considered.

As suggested in a previous editorial, "Time, Teachers, and Finance" are at least three items on any program of points for discussion of the teaching of English to engineers in the future. How to find time in an already congested curriculum for the amount of English that seems needed, is a perennial question which will perhaps be solved only when we courageously build a whole new curriculum in the light of our new knowledge. Finance is a matter to be discussed in the privacy of ones dean's office. It is too delicate a subject, and

fraught with too many embarrassing complications, to prove a profitable or happy choice for a joint conference such as is proposed. But the problem of the Teacher of English,—the man, or woman, who is to achieve the herculean task of giving the student the speech of a cultured man, and is to inspire him with a love of books and a discriminating taste for the best,—here is surely a topic that may well fill that nearing next June at Orono with profit to us all.

The subject chosen for the Joint Conference is, "The Teacher of English in the Engineering College." The detailed list of questions to be discussed may well come later, but the Committee on English is very gravely concerned as to what can be done to arouse the teachers of English in this country to this inspiring opportunity for educational service. The Committee acknowledges with deep appreciation the response which engineering educators have given to its appeals for cooperation in extending and integrating the work in English in our colleges. But the response of the teachers of English themselves has been given with many reservations. What can be done to overcome this reluctance of the teachers of English to join their lot with engineering educators, to convince them that they will not jeopardize their professional standing, nor their opportunities for advancement by throwing themselves enthusiastically into the intriguing task of giving the engineering colleges what they see they need?

Unless some of these questions can be answered by someone, the engineering colleges will soon be in the position of regarding English Composition as next to Mathematics and Physics in importance, but having to be satisfied with young, inexperienced teachers for the most difficult task any teacher can attempt, *i.e.*, that of teaching men to write. The little company of enthusiasts who have pioneered in this field the past twenty years do not see their ranks filling with recruits as rapidly as they might wish. Some reasons for this they understand, some they can only half guess at. At least it is evidently the wise thing for both deans and teachers of English to get together to talk the situation over fully.

In addition to the Joint Conference of deans and teachers of English, there will be at least one round-table conference for the teachers of English themselves. At this Conference Miss Harbarger, of Ohio State, will present for discussion the survey of the teaching of Freshman Composition, on which she has been engaged for the past two years. An opportunity will also be given for the free and full discussion of the many problems in the teaching of English which are of interest perhaps only to the teachers themselves. The Committee on English will also be, as usual, in daily session, and invites to its discussions any who are interested to attend.

Correspondence is solicited on the subject, "The Teacher of English in the Engineering College," to be discussed at the University of Maine in June, in the special joint session of deans and others interested in the teaching of English to engineering students. Suggestions would also be welcome for the schedule of questions to be discussed at the round-table conference of English teachers. Address J. Raleigh Nelson, Chairman, 927 Forest Ave., Ann Arbor, Michigan.

GENERAL CHEMISTRY FOR ENGINEERING STUDENTS.

BY R. E. KIRK AND G. B. HEISIG.

There seems to be present in engineering education a decided trend toward "fundamentals." Exactly what these fundamentals are, has been the subject of much discussion. However, most educators agree that the general principles of the physical sciences should be included in this category. Since it is probable that, for some time at least, instruction in these principles will continue to be given under the standard heads of physics and chemistry, the content of these courses and the methods of teaching them is, and rightly should be, subject to periodic inspection.

More criticism has been directed toward the subject matter taught in chemistry than that in physics. This is due, in our opinion, to two related causes. First, the course in physics is more definitely standardized than that in chemistry. Second, professional courses taught in engineering departments are based more definitely on the generally accepted standard courses in physics. The relationship between advanced professional courses in engineering and the fundamental course in chemistry is not so well established. For example, nearly all civil engineering curricula contain a course on the strength of materials, but only a few contain a course on the chemistry of materials. The same thing is true of most architectural courses. Similar illustrations could be drawn from the curricula in each of the fields of engineering.

In view of this recurrent interest in the content of general chemistry courses for enginering students, it seems appropriate to present a statement of what is being attempted in general chemistry at the University of Minnesota. It is the policy of the Division of General Inorganic Chemistry at this university to section students, whenever possible, by professional or pre-professional groups. This policy has allowed

the development of a distinctive course in general chemistry for engineering students. A division is also made in each group on the basis of whether or not chemistry has been studied in the secondary school.

The writers wish to make it plain that they do not favor giving a highly denatured course in an endeavor to make chemistry either easy or popular. The course given is essentially one in fundamental chemistry. However, a definite attempt is made to capitalize the professional spirit and interest of the engineering students by the presentation of illustrations drawn from the various fields of engineering. The aims of the course may be enumerated as follows:

1. To teach the general principles of chemistry.
2. To develop the ability to use these principles in solving engineering problems.
3. To present and explain the scientific mode of thought and method of attack.
4. To give an appreciation of the functions and purposes of chemists and chemical engineers in an industrial organization.
5. To develop, as far as possible, the ability to understand and interpret chemical data and reports by chemists (analyses, specifications, flow sheets, etc.).
6. To develop habits of neatness and forethought in the planning of work.

The courses are given by quarters: two quarters of General Inorganic Chemistry and one of Qualitative Chemical Analysis. Students entering without high school chemistry take five credits per quarter of general chemistry, while the others take four credits per quarter. More laboratory and quiz work is required of the students without previous training in chemistry. Both classes of students take the same five credit course in Qualitative Analysis in the third quarter.

The method of teaching used is essentially the lecture and examination system usual in university courses. It is not the intent of this article to either defend or condemn this method.

The financial limitations placed on most institutions are such that the lecture method is of necessity the one employed. An attempt has been made to use this method to the best possible advantage.

The lectures are outlined on the board as an aid to note-taking. They conform as closely as is practicable to the mode of presentation in the textbook. They are designed to emphasize the fundamental principles of the work. Illustrative material is used which is drawn when possible from the students probable experience or from usual industrial operations. The more difficult points are explained in detail. No attempt is made to make the lecture meetings "church services" which cannot be interrupted by the auditors if some point seems obscure. While the lecture method of necessity allows very little time or opportunity for class discussion, the asking of pertinent questions, both by the instructor and students, frequently occurs. Such questions also serve to tell the lecturer how well he is succeeding in stimulating other minds to think with his. When time permits, brief class discussions are held.

Regular weekly examinations are given. The work of the week is covered in as great detail as possible, and "original proposition" questions are asked.

The content of the course is essentially as follows:

(1) The general principles of the science.
(2) Descriptive material selected to:
    (*a*) illustrate best the general principles
    (*b*) suggest and illustrate a limited number of industrial applications.
    (*c*) give the student a certain amount of chemical information about substances and their distinctive properties.
    (*d*) enable the student to appreciate and interpret phenomena which he observes in his daily life.

No attempt is made to isolate principles from descriptive matter.

The section for those students who have not taken chemistry in the high school, studies much the same material as the sections of students who have had chemistry in the high school. The pace is slower at first, and more emphasis is placed on the descriptive side; whereas in the sections for students having studied high school chemistry the greater emphasis is placed on the material which has not been enlarged upon in the high school. It should be noted at this point that most of the students who enter the Engineering College at the University of Minnesota have had very good and comprehensive courses in chemistry in the high school. Especially is this true, save in a few glaring cases, of the students from the larger school systems of the state; *i.e.*, Minneapolis, St. Paul, Duluth and the "Range" cities.

The laboratory work represents the greatest departure from the usual procedure. It is based upon a series of experiments assembled by the writers and published in mimeograph form. These are designed to illustrate, in problem form, the material studied in class. Each experiment is a unit of work with preliminary readings indicated, and illustrating problems appended. The experiments are nearly all quantitative in character. Each experiment requires an entire laboratory period for its completion.

A complete and well written report on each experiment is required. These are placed in loose leaf folders and handed to the instructor at the end of the period. The questions are to be answered and the problems are to be solved before the student comes to the laboratory. The answers and solutions are submitted as an integral part of the laboratory report. When the students enter the laboratory they are required to hand to their section instructors a brief statement of the materials needed in the current experiment and of the method which they plan to use in the work.

We feel that the advantage in the procedure just outlined is that the students come to the laboratory with a coherent idea of what is to be done and how to do it. They no longer consider chemistry laboratory work as being a series of tricks

performed with a test tube in one hand and a direction book in the other. The method has the added advantage that in most cases the student is well aware when he leaves the laboratory as to whether he has succeeded or failed in the assigned experiment.

The experiments have been selected to agree with the announced purpose of the writers; *i.e.*, to use material which will capitalize the professional spirit of the students. Many of the experiments are essentially the same ones that are often used by other groups of students in general chemistry. The assigned exercises and problems are, however, designed to show how the principles involved in the experiment may be applied industrially. As has already been pointed out, the arrangement of the work in larger units also tends to engage the interest of the would-be engineer. When a sufficient foundation of experience and technique has been laid, certain experiments dealing with engineering materials are introduced. The students are asked to bring their own samples of coal, water, etc., for analysis. Each year certain selected students are allowed to investigate some engineering materials other than those required in the course.

The experiments dealing with the various types of engineering materials are primarily designed to acquaint the students with the chemical composition and characteristics of such materials. While the usual methods of technical analysis are employed in many cases, the major emphasis is placed on the interpretation of the results rather than on extreme accuracy.

The students who have successfully completed the year's work in chemistry are eligible to elect several advanced courses in chemistry of especial value to engineers. The fact that from sixty to seventy engineering students each year elect additional work in chemistry seems to the writers an assurance that the type of course here described enlists the interest of technical students in this "fundamental" science.

CLASS SIZE AND STUDENT ACHIEVEMENT.

Digest of an address made before the Minnesota Section, S. P. E. E., November 9, 1926, by EARL HUDELSON.

Chairman of the Sub-Committee on Class Size.

As universities are ordinarily administered to-day, class size is the greatest single determinant of educational cost. Increasing the size of classes, then, offers such an obvious and tempting means of lowering the immediate cost of higher education that the whole problem of the relation of class size to educational efficiency warrants a wide but thorough and impartial investigation.

The University of Minnesota is now in the third year of such an investigation. The Committee on University Research, appointed by the President to investigate whatever it conceived to be outstanding educational problems at Minnesota, delegated a sub-committee to inquire into the question of class size. The sub-committee drew up an experimental technique for attacking the problem, made this technique available to any instructor who might be interested in the question, and offered its technical services in the administration of experiments and in the interpretation of results.

The inquiry has assumed a threefold nature. First, the sub-committee studied trends in class size over the past five years and the relation of these trends to the distribution of scholarship marks. While class size has remained relatively constant in certain departments and has even decreased slightly in a few others, the general tendency has been toward decidedly larger class units. In one college the average class size has more than doubled since 1920. The distribution of scholarship marks, however, has remained practically unaffected by this increase in class size. The only difference which the sub-committee feels is significant reveals that there has been a lower percentage of failures in the large sections than in the small sections of one populous junior college course.

The frequent claim that large classes handicap student achievement is not confirmed by instructors' marks.

Controlled experiments on class size have been completed in seventeen classes under ten different instructors in seven different courses in three different colleges. Twenty other experiments are either under way or pending. Results have been analyzed for seven of the completed units, and the others are now being studied. So many factors must be considered that complete analysis is a slow process. It involves such questions as the effect of pupil homogeneity upon class size; the relation of class size to pupil intelligence, to the magnitude of difference in size between the two sections, and to the relative showing of the two groups on subjective tests, on objective tests, on the final examination, on oral recitations, and on written reports; the attitude of students and teachers toward class size; the physical and emotional effects of large and small classes upon teachers and students; the possibilities of instructional or clerical assistance in large classes; the relation of teaching methods and class organization to class size; and the physical and other practical limitations of class size.

Though it will be some time before the effects of all of these factors can be determined for all of the experiments, certain general tendencies are already apparent. It appears that, on the whole, the size of the class in the courses thus far investigated has little or no effect upon results measured in terms of student achievement. It may be that there are important educational outcomes accruing, or at least accruable, only from small classes which have not been detected in these experiments because no one knew how to measure them; but such outcomes as were measured seem to be unaffected by class size.

Just how much bigger a large class is than a small class, is an academic question. The sub-committee has assumed the position that the difference in class size should be so much greater than any other inequality that whatever differences result will be more likely to arise from size than from any other factor. Anything below thirty-one has been called a

small class. Large sections have ranged from 60 to 250. The ratios have ranged from approximately 2 to 1 to approximately 7 to 1. Course content has been kept constant for both sections in each experiment. Prior to the present year, methods of instruction have also been kept uniform in both sections; but a number of experimenters are now making a conscious effort to adapt their procedures to the size of the class. Unusually frequent and thorough tests are administered to both sections in each experimental unit. These tests are generally of the objective type but are sometimes supplemented by subjective quizzes. Each student in the large class is paired with a student in a small class on the basis of intelligence and, in most experiments, on the basis of past scholarship records also. This method of pairing insures comparability, both as to central tendency and variability, to the degree that the standards of selection are reliable.

No experiments in either the pure or physical sciences have yet been completed. They call for modifications of the experimental technique which the sub-committee felt incompetent to make alone. The laboratory situation is unique in its physical limitations, and other aspects of the science situation are peculiar to that one field. With the coöperation of the instructor, however, an experimental procedure has been devised for a course in physics and a controlled experiment on class size is now under way. Other units in the natural sciences and in mathematics are being projected.

The third phase of the inquiry is in the nature of a questionnaire. Blank forms will be sent to all faculty members and to students and alumni, calling for analytical reactions to their experiences with classes of various sizes. While this procedure does not rank with the others in scientific accuracy, the responses may reveal practical implications of the problem of class size which the other techniques do not expose.

The sub-committee is not yet disposed to make any recommendations concerning class size. It hopes, rather, that the question will be attacked experimentally by many more instructors in various departments under various conditions and

methods of instruction. The committee holds itself in readiness to encourage and assist all who may care to contribute experimentally to the solution or solutions of the problem.

Discussion.

John V. Martenis: The proper size of class that will be best adapted for instruction in a college course should be determined from considerations of character of the course; student attitude toward the course; objective of the course.

A course that is advantageously administered by the lecture method, sets no definite limitation on the maximum number in the class, in fact a large class tends toward greater enthusiasm both in the student and in the lecturer. A design or a laboratory course is necessarily limited to a number which may be efficiently handled by one person.

In the present system of arranging a program of study to meet the needs of a particular course, the average student group does not have the same enthusiasm toward all of the studies introduced in the course and a more intimate contact between student and instructor would be desirable to enlist the interest of the student in an unattractive study. In such cases, individual attention will often overcome an antagonistic attitude of the student toward the study or at least prevent a loss of morale. The diversity of mental equipment found in the average student body indicates that a selected number from a large group can progress more rapidly than the others in the group and it would not be wise nor fair to them to adapt the progress rate to those less fortunate in their mental equipment.

The objective of the study may be that of general information tending toward the broadening of the mental horizon or that of developing the thinking and reasoning processes of the mind. The latter objective often requires individual instruction and would therefore limit the size of the class.

Another desirable feature of a college course, often disregarded, is the impetus given to the student by the close and sympathetic friendship which may be developed between him

and his instructor and adviser. This condition is not easily attained where the number in the class is large.

Franklin W. Springer: After experimenting for more than fifteen years in classes up to eighty-five and laboratory sections as large as twenty-five, I have reached the following conclusions:

Satisfactory educational results should be obtained by experienced instructors, using proper methods, in case of electrical engineering sophomores, juniors, and seniors, in *classes* up to something greater than 100 per section, *depending upon the class room conditions and arrangements* (ventilation, acoustics temperature, illumination, vision, tablet chair comfort, and humidity).

In the regular electrical *laboratory* work, experience indicates a maximum of 10 to 12 per section for sophomores, 14 to 18 for juniors, and 16 to 24 for seniors. In the case of each course, the smaller number applies to the first quarter of the year's work, and particularly to the first half of the first quarter. It is found that in the latter part of the year, students have become more self-directive in each of their courses and this is true not only from quarter to quarter of one year, but from year to year. A fair average would be *10 sophomores, 16 juniors, and 20 seniors* per laboratory section which numbers should not be exceeded, particularly, in the beginning quarter of a year course.

These, however, are not all: there are many other, possibly controlling factors, as follows:

1. The larger percentage of engineering educators seem to favor small class and laboratory sections for various reasons. It is not, at present, a popular thing to advocate or to practice handling large classes in engineering.

2. There is much other work to be done in a department besides the teaching itself. Large sections tend to reduce the numerical strength of a department and this reduces its influence in so far as numbers count. The range of specialities, as effecting research and public service, is also influenced, generally reduced.

3. Large sections with fewer instructors will not likely have a good effect on research work unless the discrepancy is deliberately offset in some other way.

4. Credit in work is generally thought to be rated in terms of credit-hours per week, irrespective of the size of classes. It is a heavier load to carry large classes than small ones, and instructors do not wish to be penalized themselves or to have their respective departments placed at a relative disadvantage in obtaining needed help.

5. Program difficulties are likely to arise in the upper years, owing to the likelihood of some of the students being cut out of certain electives by having only one class section as in electrical engineering. No doubt, these difficulties could be minimized by the Program Committee.

6. A general policy of large classes would immediately require re-arranged and re-designed class rooms and laboratories in many cases (a large order).

7. There are advantages and disadvantages of large and small classes. The large class stimulates the instructor more than a small one, also, just as no one would care to see a theatrical performance or hear a sermon alone, there is a certain amount of driving force and stimulation felt by the individuals of a large class as a result of numbers.

8. No advocate of large classes would likely contend that a teacher could do better work in general with 100 per section than with only 25 per section, disregarding cost; but most teachers would admit that, for the same cost, better educational results would be obtained by an experienced teacher having 100 students in a class section, than by four inexperienced teachers with 25 per section.

9. Until the problem is solved to the point where administrations can deliberately support and encourage large classes, it would not seem to be advisable for a particular department to attempt it on a complete scale.

Illustrative Comments.

Consider one experienced teacher receiving $6,000 handling a section of 100 students, assisted by a part-time teaching

fellow receiving $800 for correcting papers, in comparison with the same 100 students taught in sections of 25 by 4 instructors receiving $1,700 each. Note further that, if good instructors could be obtained for $1,700, they would be immediate candidates for substantial increases.

In the case of addresses, lectures, demonstrations, written recitations and examinations, the limit in number of students is probably much higher than many engineering teachers suspect. At a recent convocation, the President spoke to an audience of several thousand. In order that all might hear perfectly, a public address system for sound amplification was used. Clearly in such a case, being able to see the speaker would set the limit to the maximum number. No one would likely believe that such an address or lecture would be more effective if delivered in sections of 25.

It is just possible that engineering teachers, habituated to small classes and small laboratory sections owing to the natural limitations resulting from small registration and divisions into specialties, have failed to note some of the advantages of large classes such as may be found in other colleges. No doubt, there are courses and parts of courses in engineering which could be handled with satisfactory educational results in large sections.

Undoubtedly, each course will have to be studied by itself and the optimum sized classes and laboratory sections decided upon by the needs of each case. The range in size may be one to 100,000. Unseen audiences, by radio, may be millions in number. Shop work, ordinary engineering laboratory and research work, oral foreign language practice, music, and other *supervised practice sections* should, of course, be limited to that number such that proper individual attention may be given to students, but it would seem that no such limitations need apply to lectures, written recitations, examinations, or demonstrations.

T. A. H. Teeter: I have heard with great interest Professor Hudelson's paper on the Relative Merits of Large and Small Classes.

While the data Mr. Hudelson has at hand do not point to any sharp distinction in the relative merits of large and small classes so far as efficiency of instruction is concerned, I have long felt that within certain limits the better results were secured from a large class.

The criticism I would make of Mr. Hudelson's so-called small classes is that they are not small enough to be indicative. We have, I believe, in this institution a number of classes as small as 8 or 10 persons—possibly some smaller at times. Observation over a period of 20 years leads me to believe that classes smaller than 10, say, with the exception of certain laboratory sections were excusable only on the ground that the course was required and there were too few students registered to make it larger. In such a case our obligation to the student who has registered, in some manner excuses the small class, but in the majority of cases efficiency in instruction drops with numbers for two reasons.

1. The instructor's inspiration depends to a great extent on numbers.

2. The rivalry or competitive incentive among the students themselves degenerates with decreasing numbers. Mr. Hudelson's data neither prove nor disprove this postulate.

A sane discussion of the relative merits of large and small classes must of necessity look to the following factors:

1. The content of the course.

2. The personality and teaching ability of the instructor as well as his ability as a public speaker.

3. The type of the students as individuals and their motives in taking the particular course.

4. The composite or collective ability of the students as a class.

Discussion of These Factors.

1. Need to consider differences in content of courses as affecting the tests cited by Mr. Hudelson has, I believe, been largely eliminated by comparing large and small classes in the same subject.

2. The factor of the personality of the instructor has not

been eliminated entirely by using the same instructor in both large and small classes. Some instructors handle a large class better than a small one, while certain types of instructor, say the research type, might do immensely better with a small class than with a large one. The natural public speaker or natural salesman will handle a large class better. The natural research man will chafe under the strain of large classes but will handle a small group better but by entirely different methods.

This suggests that the efficient method for large classes may be different from that for small classes. We believe we see the problem working out this way in our evening classes in the Extension Division. There the size of the class is influenced somewhat by the mutual sympathy between student and instructor. Men who handle large classes well get large classes; those who handle small classes well get small classes; for reasons we cannot explain yet.

3. The type of student with reference to motive and ambition as well as with reference to intelligence quotient is an important factor. That is to say we need to know something of the student's relative ambition or drive. He may be intelligent but lazy, or mediocre intellectually but ambitious. With reference to motive he may have elected a subject because of his personal interest in that subject, or again, a student may elect a subject because he needs 5 or 6 easy credits to get a diploma. In the first instance we might expect a good mark, in the second, a mediocre or poor mark regardless of class size.

In evening classes in mathematical and technical subjects the latter motive is largely eliminated. Our experience indicates that:

I. Large classes do as well as small classes, or better, in the *more elementary* subjects.

II. The process tends to reverse itself as the courses become more advanced especially where technique on the part of the student is an important factor. For example:

Shop Arithmetic can be handled splendidly in large classes,

certainly better in classes of 25 to 50 than in classes of 8 to 12. On the other hand our experience shows that under the same teacher Integral Calculus yields better results when the classes are not over 15 to 20. Our best students in advanced mathematics are found in small classes, but, as I have pointed out before, technique, becomes a more important factor in Calculus than in Arithmetic.

Classes vary greatly from time to time and even in the same year. The fact that the aggregate motive, ambition, and interest of a small class may be entirely different from that of a large class or vice versa makes exact data difficult to procure. Classes are temperamental. Often intellectual inertia that is not explainable on grounds of intelligence or motive of student or on ability of teacher develops in a certain class. Composite past experiences of students may explain it, but how can one measure composite experience?

I have in mind an evening class of 18 of two years ago which did just double the work of a class of 7 this past year. The training for two semesters previous was identical, and the subject matter, instructor, and text material were the same. The size of class within limits as yet undetermined is to my mind a minor factor in efficiency of instruction—a minor factor with the predominance of evidence in favor of the large class.

Efficiency of the instructor and interest of the student are far more important factors.

SECTIONS AND BRANCHES.

A Meeting of the Minnesota Section was held January 27, at 8 o'clock, in the Dining Room of the Campus Club. The Minutes of the two previous meetings were read and approved after a minor correction.

President Martenis then introduced the speaker of the evening, Professor W. E. Brooke. Professor Brooke's subject was "What is the Society for the Promotion of Engineering Education Doing?" Slides were used to show the results which have been obtained by the various committees. The speaker handled his subject in an informal way and comments on the slides were made by a large proportion of the 31 members and their friends who were present.

Professor Springer, Kirchner and Dalaker were appointed as members of the committee to draft resolutions on the death of Professor Shepardson, the late Head of the Electrical Engineering Department.

GEORGE DEFREES SHEPARDSON,

1864–1926.

In the death of Professor George Defrees Shepardson the Minnesota Section of the Society for the Promotion of Engineering Education recognizes and feels that it has lost one of its most valued members.

Professor Shepardson was one of the founders of the National Society and was instrumental in the organization of the Minnesota Section in which he always took an active part.

His fellow members of this section will always remember and revere him for his never failing courtesy and assistance, for his tolerance, fairness and willingness to serve and to give his time and thought to the work of the Society.

Therefore: Be it resolved that this expression of our esteem of Professor Shepardson be made a part of the permanent records of the Section and that a copy thereof be sent to his family.

FRANKLIN W. SPRINGER,
W. H. KIRCHNER,
H. H. DALAKER,
G. B. HEISIG,
Secretary.

COLLEGE NOTES.

Dr. Frank J. Goodnow, President of **The Johns Hopkins University,** has authorized the following statement in reference to the future of the School of Engineering:

"Much interest has been displayed in the New Plan for University work at The Johns Hopkins University. This plan applies particularly to the Philosophical Faculty. For the present, the School of Engineering will continue as formerly to offer its regular four year undergraduate courses and graduate instruction. Only such changes in curricula will be made as are necessary to conform with the modified courses in the College of Arts and Sciences."

POSITION WANTED.

Engineer with six years experience in teaching mechanical engineering subjects and seven years industrial experience including design, construction and operation, at present engaged in industrial work, desires to return to teaching profession next fall. Preferred location, southern or Pacific coast states. D–197.